

A High Speed Tunable Etalon for LIDAR, Phase I

Completed Technology Project (2018 - 2019)



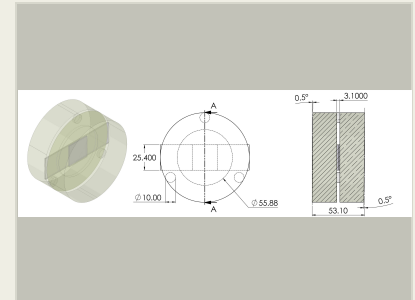
Project Introduction

A solid state yet rapidly tunable filter based on liquid crystal (LC) etalon technology is designed by determination of minimized LC birefringence response time in an optimized electric field. The key technological innovation is the use of liquid crystal to tune the etalon. While this type of etalon has been in use for many years, a development effort is undertaken to reduce the time it takes to tune a LC etalon over a free spectral range from a few milliseconds (current state of the art) to 100-500 microseconds (proposed). The primary application of this technology is integration into a space based lidar (light detection and ranging) system, particularly in differential absorption lidar (DIAL) systems. DIAL is one of the most powerful active remote sensing techniques due to its spatial and altitude resolution, measurement precision, and insensitivity to surface emissivity. As such, it can be used to monitor spatial and temporal changes of minor molecular atmospheric constituents in the lower troposphere. The filter is designed for observing water vapor from orbit. An accurate assessment of global water vapor distribution is key to more precise modeling of climate feedback from clouds and improved weather forecasting.

Anticipated Benefits

The primary application is the provision of fast frequency tuning for space based lidar systems. However, the proposed tunable etalon can be modified for use in on-orbit hyperspectral imaging systems or high speed dynamics sampling. A promising non-lidar application is micro-scale sampling of atmospheric winds or measuring the O₂-A band emission to determine temperature profiles at high temporal cadence.

Non-government applications include use as a spectral sensor for narrow spectral signatures with applications in the oil and gas markets, both exploration and leak and pollution detection. Mineral detection and the detection of chemical impurities in minerals as well as agriculture are also potential applications. All of these markets are looking to expand their observational capabilities and will experience high degree of growth over the next decade.



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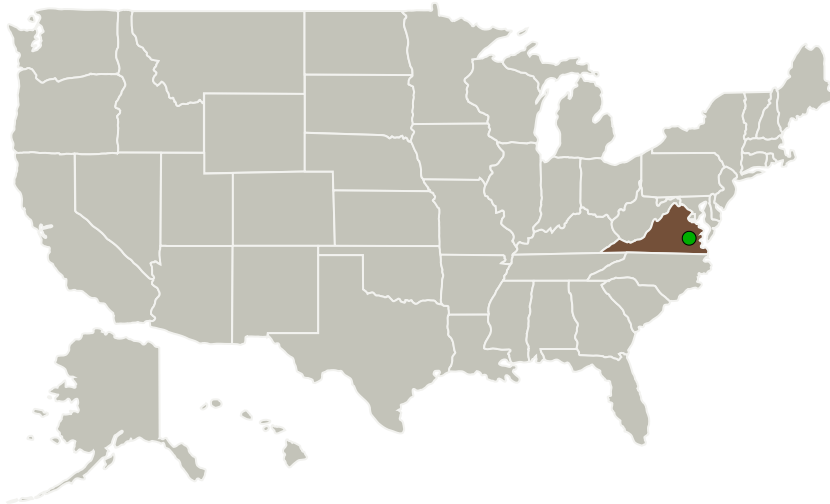
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Computational Physics, Inc.(CPI)	Lead Organization	Industry	Springfield, Virginia
● Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations

Virginia

Project Transitions

July 2018: Project Start

February 2019: Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/140885>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Computational Physics, Inc. (CPI)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

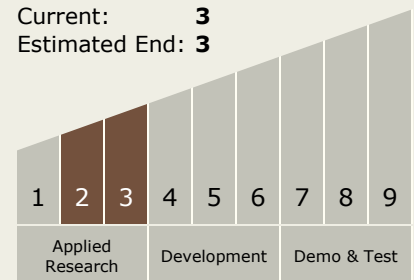
John Noto

Technology Maturity (TRL)

Start: 2

Current: 3

Estimated End: 3

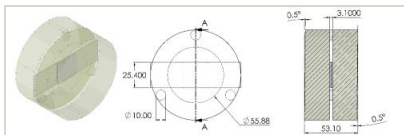


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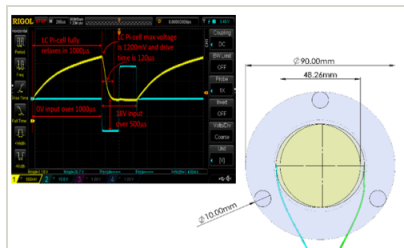
Images



Briefing Chart Image

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(<https://techport.nasa.gov/image/132820>)



Final Summary Chart Image

A High Speed Tunable Etalon for LIDAR, Phase I

(<https://techport.nasa.gov/image/127791>)

Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.1 Remote Sensing Instruments/Sensors
 - └ TX08.1.5 Lasers

Target Destination

Earth